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ADVENTURES OF A WATERMOL

A Romance of the Air, the Earth and the Sea

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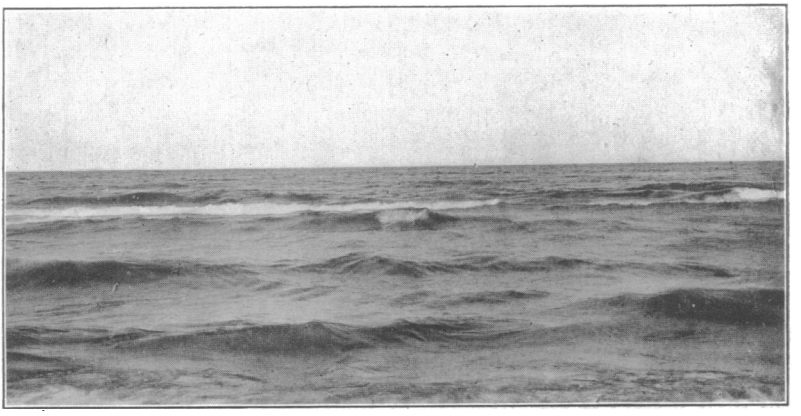
Prelude

I AM only a tiny molecule of water, and so very small that no eye has ever seen me, not even with the strongest microscope. Yet I am an actual thing of real substance. Of such as I are all the clouds and rain composed, all the rivers and riverlets, all the seas and lakes, and the whole of the vast ocean. Nearly all the substance of plant and animal bodies is built of us watermols. We are found in nearly everything, even in the minerals and solid rocks of the globe. And I am very, very old. I have been around the world many times and have had a wonderful history.

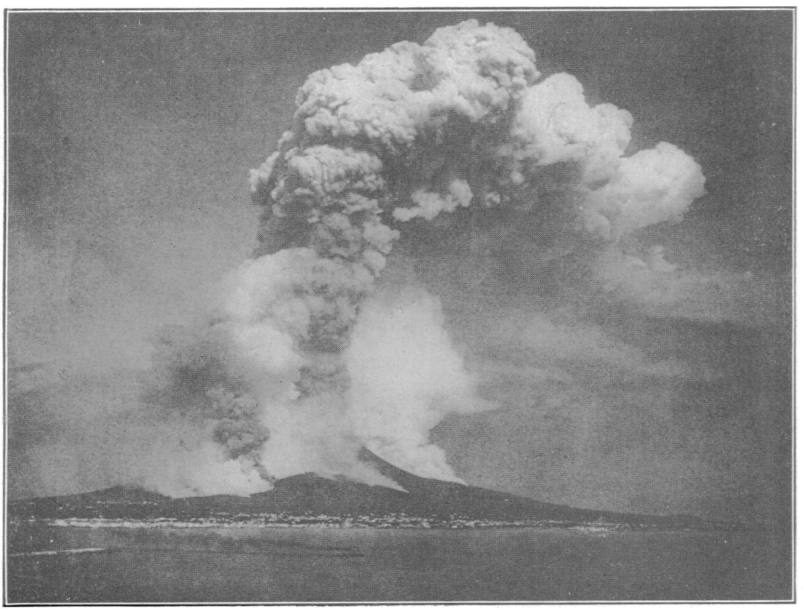
You wish to hear the story of my life?

It is a long, long story, for my birth was far back in the old earth's early time. To relate in detail the story of my adventures would be too long for you, poor creature of less than a century of life, even could I



N. R. Graves, photo.

Fig. 1. Merely a few Watermols.



Courtesy of Eastman Kodak Co.

FIG. 2. BIRTH OF WATERMOLS.

take the time from my duty as a globe-wanderer. I can tell you only a few of the strange and romantic events in the life history of a watermol who has been in active duty and a part of the earth's history for a hundred million years. Some of my adventures are so strange that you might doubt my truth, but I could not tell untruth, for I am a part of the reality and verity of the universe.

BIRTH, IN A VOLCANO

There was a time when I, as a watermol, did not exist. I had a creation, a sort of birth, far back in ancient geologic time, scores of millions of years ago. My birth was in a singular manner and under remarkable conditions. It took place deep in the hot chimney of an ancient volcano. Not of any volcano now existing, as it happened long before any volcanic mountains that are now standing were formed.

Not like any organic being was I born, that is, as a little fragment or cell of the mother animal or plant. I was created by the union of three distinct individual particles. Two atoms of hydrogen and one of oxygen united to produce *me*.

I am a composite being, a chemical creation; the child of wedded matter and energy; I am a tiny sample of the infinite cosmos.

These three atoms, or units, had existed from the eternity of the past, and their history is infinitely longer than mine, and it must have been remarkable. If we knew their history we might have a clue to the

origin of the sun and of the vicissitudes of stars and nebulæ. They must have been in the nebular matter or cosmic dust that formed the sun, and in the evolution of the solar system they became attached to the earth. If they had any choice in the matter we may suppose that the earth offered some peculiar attraction. Perhaps they foresaw the strange phenomena called life. These tiny atoms helped to build the earth, for in some material they fell on the surface of the growing planet when the globe was not half its present size. At the time of my creation the three atoms lay close together in the very hot stuff or lava down in the pipe or chimney of the volcano. Under the intense pressure and heat at great depth in the earth such atoms could not unite, but with the lower temperature in the tube of the volcano they were able to lock arms and blend together into one body—and here am I, the result.

At the time when I was created I was only one of the countless millions of millions of water molecules all made in the same way. We were very hot and packed close together under great pressure. As we all worked our way upward in the tube of the volcano we were finally able to overcome the compression, and suddenly we drew apart and produced an instant expansion or steam explosion which blew the top of the volcanic mountain into pieces, and forced a huge column of water vapor to a height of miles in the atmosphere. Most of the water on the earth's surface, including the ocean, was probably formed in this manner.

I was one of the particles of invisible water, or steam, that wrecked the mountain; and I found myself, a new creation, a distinct, complex being, high up in the rare atmosphere.

By the volcanic explosion and the heated air current I was carried

I. P. Bishop, photo.

FIG. 3. WATERMOLS IN AERIAL JOURNEY.

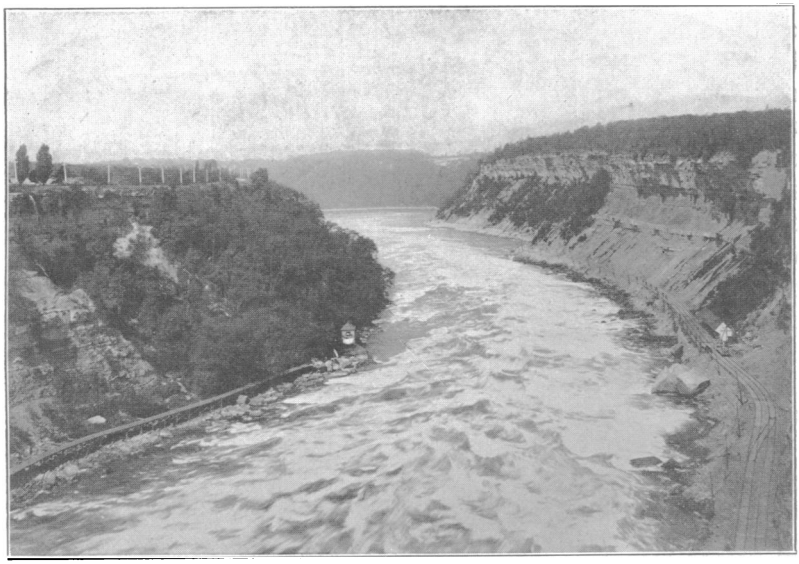


FIG. 4. WATERMOLS IN HASTE.

up high into the atmosphere. Of course I did not measure the height, for I had no measuring stick, but I guess it was about ten miles. I was held up, as a separate watermol, in the grasp of the molecules of nitrogen and oxygen which chiefly compose the mass of the gas envelope surrounding the earth, and called the atmosphere. All about were endless millions of other watermols, flying swiftly back and forth as they collided with each other and with the air molecules. What the purpose or reason was I do not know. Really, what is the purpose of anything?

It was a free life, miles up in the sky. We were carried swiftly eastward in the great wind currents that at high altitude always sweep around the globe from west to east. Along with the multitudes of my fellow watermols, and also molecules of other kinds, and dust particles, I circled the globe.

It was a joyous life. The air was thin or rare and we watermols were not closely confined in our captivity, but were permitted to move rapidly back and forth, for molecules are very restless, fidgety things. We were always hitting each other and bounding back and forth in all directions, many millions of times a second, because of our high elasticity. In scientific language this is called molecular vibration.

We were above all the clouds and storms, as these belong only in the lower strata of the atmosphere. At that great height the sky above was black, the sun was blue and the stars could be seen at midday. The density of the air at the height of ten miles is only about one tenth as great as at the earth's surface, and one half of all the mass of the atmosphere is within three and one half miles from the ground. At

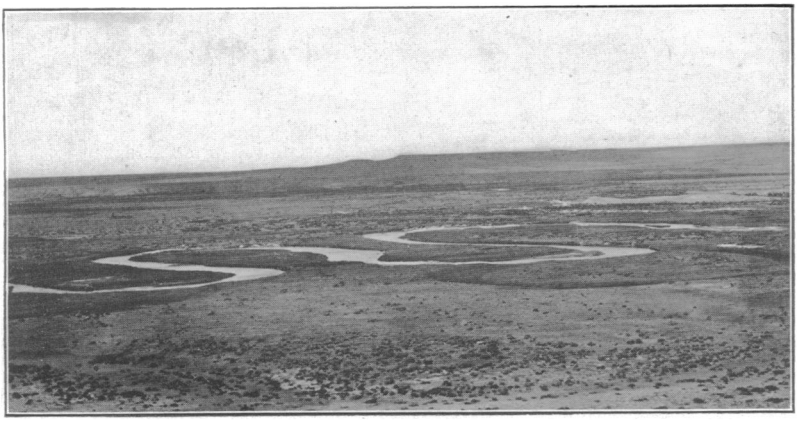
that height in the thin air the sun was terribly hot but the air temperature was far below freezing, for the sun's heat rays pierced right through the air without warming it. But all this made no difference to me, for to a separate molecule there is no such thing as temperature, heat being an effect of the movement or vibration of molecules when many are crowded close together.

In a Cloud

After traveling a long time in the upper air some change took place in that part of the atmosphere which held us captive, and thousands of us watermols were allowed to attach ourselves to a little mote of dust or solid particle. We now formed a tiny mass of solid water, an ice crystal, but yet so small that we floated in the thin upper air. Myriads of other water crystals also formed, and together we made a little cloud, floating high in the heavens.

This time was long before man appeared on the earth and even before any air-breathing animals lived. If the animals in the sea which had eyes could look up in the sky they might have seen us as a little fleecy, cirrus cloud floating idly in the blue dome.

Sometimes the air molecules crowded closer together about our ice crystal and pulled us watermols apart, and we were again separate or free, and the wispy cloud vanished. At such times the temperature had risen and the ice crystals had evaporated, or, in other words, the cloud had dissolved in the air. Such changes occurred many times. Finally, at a time when we were lower in the air, and all the molecules of every kind were close and in rapid vibration, which means that the temperature was higher, we watermols were allowed to cling to a dust particle so as to make a tiny sphere of fluid water. The myriads of water spheres together formed a little cloud, just as the ice crystals had done at higher and colder altitudes. Our cloud of



N. R. Graves, photo.

Fig. 5. Watermols Traveling at Leisure.

FIG. 6. WATERMOLS FROZEN AND NEAR FROZEN.

water spheres grew by adding more watermols until it was a great, dark cloud, overspreading the sky and shutting off the sunlight from a space on the ground beneath. Two mysterious forces were acting on our water spheres. Each force was a pull and a push. One force, called gravitation, tended to draw the little spheres together to make larger spheres, while the other force, called electric repulsion, tried to drive

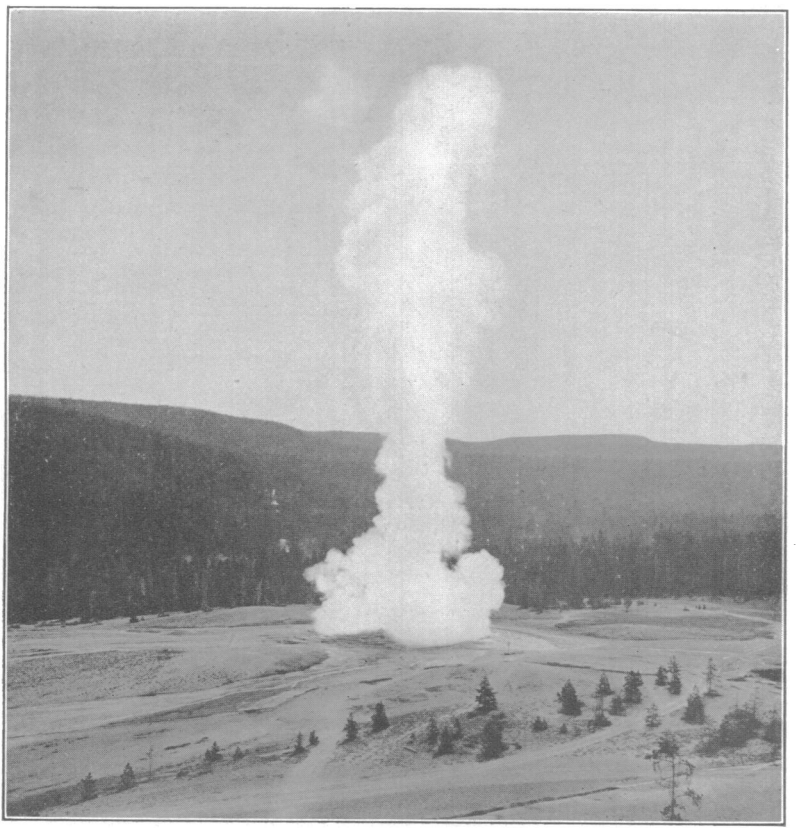


FIG. 7. WATERMOLS ENJOYING A HOT TIME.

them farther apart. Finally the electric force or the pull-apart, or push-apart, became weaker, or may be the push-together became stronger, and the tiny water particles united into larger spheres. These larger water drops were too big and heavy to float freely in the air, and they slowly fell through the air and dropped as rain in the sea. And now my individuality as a watermol was drowned in the mass of water of the limitless ocean.

IN THE OCEAN

This was a great change from the life of a free watermol, invisibly floating high up in clear sky, or even as part of a tiny ice crystal or a water sphere in a cloud. Now I was only an insignificant molecule of

water in the vast ocean. Of course I was of just as much consequence and use as any other watermol, but there were so many of us! A tiny drop of water on the point of a pin contains millions.

In the air I had been a prisoner, being held in the grasp of the air substance. Now I had to help hold other substances captive. We watermols of the sea kept as prisoners, or in solution, many kinds of molecules. There were so many kinds with such long names that it is difficult to name them. The most numerous prisoners were the molecules of chloride of sodium, commonly called salt. Next was chloride of magnesium. Then there were sulfates of magnesium, calcium and potassium, and carbonates and bromides and iodides and fluorides, even

FIG. 8. WATERMOLS CARRYING ELECTRIC CHARGES.

silver and gold, and, Oh! too many others to try to name. Just as the air molecules, as a gas, had held us watermols captive, so now we watermols as a fluid held solid substances captive, or in solution. We had a little revenge on the air, for we had as captives some molecules of nitrogen and oxygen.

In the mass of water we were tumbled about by the winds, as waves or swept along as currents or ocean rivers. There was also movement or circulation due to differences in weight and pressure produced by difference of temperature. So I was sometimes dashed against the shores of ancient continent or swept from the equator to the pole, or perhaps clear around the globe.

When we watermols were at the surface of the sea the molecules of the air would take hold of us and try to carry us away as captives. In the sunny days billions of my fellows were coaxed off into the warm air, and at last this was my fate, or good luck. I was pulled away from the

sea and lifted high into the atmosphere. Again I was in the clear sky, a care-free watermol with nothing to do but float around and look down on land and sea.

In a Glacier and Iceberg

After a long time and much journeying, sometimes as a free watermol, sometimes in vapor cloud and sometimes in frost cloud, I was

W. A. Bentley, photo.

Fig. 9. Watermols Playing Leapfrog.

again built into a tiny frost crystal, a little three-sided prism of clear, transparent ice. Floating high in the cold air our ice crystals bent the rays of sunlight and made the rings of brightness and color about the sun and moon, the halos and coronas. At last my ice crystal grew out into a beautiful six-angled snowflake; and this became part of a snow cloud. Then the cloud floated over a great mountain range in some ancient land, unknown to me, and my snowflake was added to the

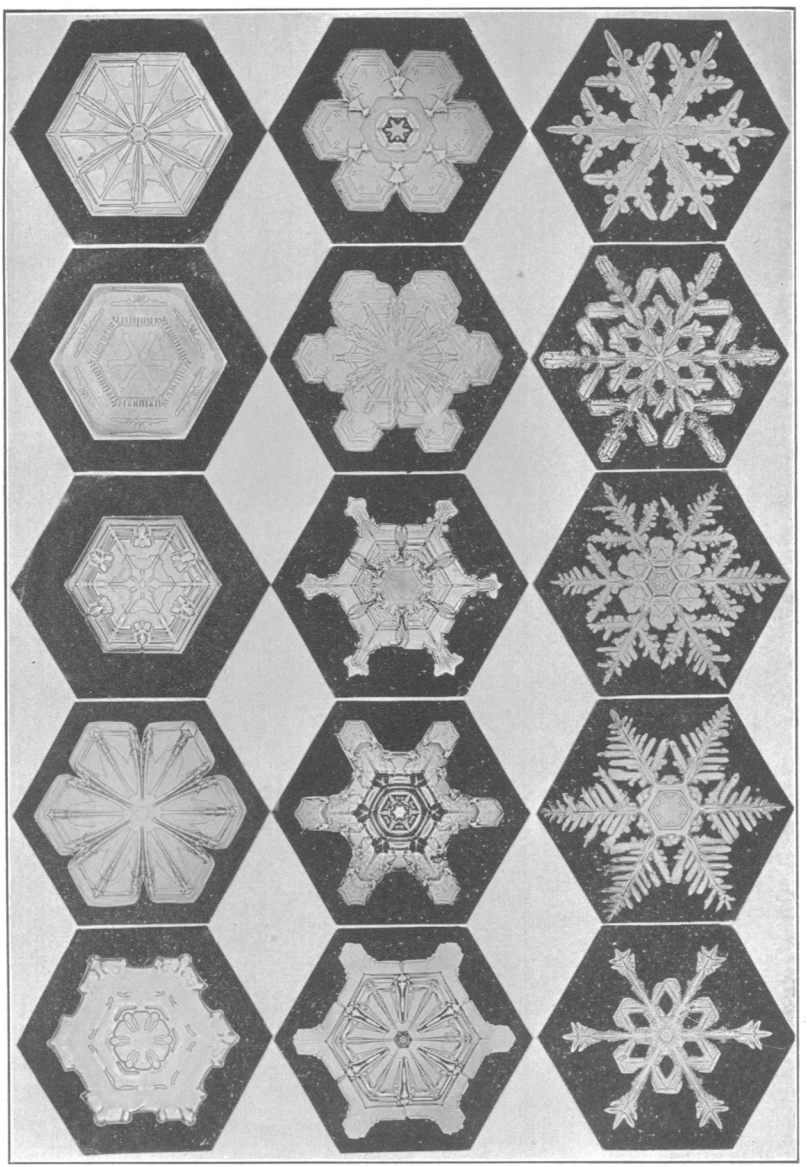


FIG. 10. WATERMOLS AS FALLING STARS.

FIG. 11. WATERMOLS AS SNOWFIELD AND GLACIER.

vast snow field on the mountain height. Other storms piled more snow over us, and so I was buried in the broad, deep snow cap.

This was pretty cold for me, who had been in the warmth of the tropic seas. But worse was yet to come, for other snowfalls buried me deeper and yet deeper in the snow mass. And then the mass of which I was a tiny part began to move slowly down the mountain slope. After some centuries the movement and the pressure compressed the snow into solid ice, and now I was in a solid, cold, transparent ice body. I was part of a glacier on some old continent in some very ancient time.

Surely, this was a great change from the careless life of a gaseous watermol in the atmosphere; or even as a part of the liquid ocean. Now I was part of a solid. And I was grasped so closely and rigidly by my icy fellow mols, all in regular crystallized ranks, that there was little chance for the vibration which is the nature of all molecules. In the air I had freedom of motion, and some chance even in the water, but now I was in a cold, close prison for ages and ages. No light, no play, not even work, but just darkness and crushing stillness! It was frozen silence.

Slowly, very slowly, I was carried along in the creeping glacier, until after what seemed endless time, I was near the end of the great ice flow and thought my freedom was near. But it was a false hope, for the part of the glacier in which I was imbedded was pushed out into the ocean. The up and down motion of the tides loosened the ice mass and it broke off and floated away in the sea as an iceberg. So I was yet in the cold prison, which drifted about in icy waters for many tedious years. But finally the iceberg broke up and went to pieces and melted away. At last I was again in the fluid water of the briny ocean.

(To be continued)